CONTRIBUTIONS TO PENNSYLVANIAN PALEOBOTANY

BY

ROBERT MAX KOSANKE

B.A., Coe College, 1940
M.A., University of Cincinnati, 1942

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN BOTANY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1952

URBANA, ILLINOIS
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Part one of the investigation is concerned with the description of a new type of calamite fructification with a re-evaluation of previous ideas concerning the phylogeny of calamite fructifications in general. The specimen, for which the name *Mazostachys pendulata* gen. et. sp. nov. is proposed, is from the Mazon Creek area in Illinois. It is preserved in an ironstone concretion from the Francis Creek shale overlying the Illinois No. 2 coal bed. Thus the specimen stratigraphically is from the lower portion of the Carbondale group of the Pennsylvanian Age. This specimen differs from the common type of plant compression found in most of these concretions in that the major portion of the specimen is preserved as a petrifaction. Thus peels and thin-sections have been employed to study the morphological and anatomical details of these fructifications.

The specimen is a calamite shoot bearing fifteen cones. The shoot axis has two nodes and one internode which are complete. In addition there is a small portion of another internode. The complete internode is 4.2 cm. in length and 6 mm. in width midway between the nodes. The nodes are slightly less than 1 cm. in width. Foliage is not attached, but preserved as a very thin carbonaceous film in the same plane as the specimen are six whorls of leaves identified as *Annularia sphenophylloides.*

The cones attain a length of approximately 2.6 cm. and a width in diameter of about 4 mm. The cones are attached by means of a peduncle, usually less than 2 mm. in length. The cone axis, with a central pith, is a dictyostele, and the primary xylem develops centrifugally. There are six vascular bundles in the internode, and these pair to form three in the region of the secondary wood in the nodes. Twelve sterile bracts arise at each node, and they are connate at the sessile attachment with the cone axis. There are six sporangiophores, each at a position just below the sterile bract of the node above. There are twelve sporangia, two attached to each sporangiophore in a pendulant manner. The sporangia are about 1.5 mm. in length, and the sporangial wall is one cell thick with radial projections. A tissue composed of parenchyma cells with numerous lacunae covers the upper portion of the sporangia and sporangiophores. This plant is homosporous, the spores averaging about 60μ in diameter and possessing a distinct *area contagionis.*

The bractless forms *Asterocalamites* and *Pothocites* are considered primitive. They occur in the Lower Carboniferous and bear whorls of peltate sporangiophores, each sporangiophore with four sporangia facing the cone axis. *Calamostachys* is believed to be derived from the bractless forms. It is like them with respect to the form of the sporangiophore and the number of sporangia, but it has bracts intercalated between the whorls of sporangiophores. *Calamostachys,* including *Macrostachya,* is thought to have evolved two distinct phyletic lines of cones among the Calamitaceae. The first line, which terminates with *Palaeostachya* and would include *Huttonia,* is characterized by a distinct pith cavity and by the axillary position of the peltate sporangiophores which bear four sporangia per sporangiophore. The second line of phyletic development starts with *Mazostachys* and terminates with *Metacalamostachys* while *Cingularia* represents a side-branch of this line. This second line is characterized by the non-peltate sporangiophores, which arise either high on the internode or immediately below the bract of the whorl above, and by the pendulant mode of attachment of the sporangia. In *Mazostachys,* which has a central pith, there are two sporangia per sporangiophore, while in *Metacalamostachys* there is but one sporangia per sporangiophore. *Cingularia* is associated with this line because of the position of the sporangiophores which bear pendulate sporangia, but it is believed to be a side-branch because the sporangiophores are strap-like and bear either four or eight sporangia depending upon the species.

Part two of this investigation is concerned with the description of a new long-leaved species of *Lepidodendron* and a review of previously described species for comparative purposes. The specimen, for which the name *L. grandifolium* sp. nov. is proposed, was found in the roof shale of the Raleigh-Wyoming Mining Company, Mine No. 2, Glen Rodgers, West Virginia. This position stratigraphically is near the base of the New River group of the lower Pottsville series of the eastern United States.

The specimen is an unbranched stem more than 40 inches long bearing attached leaves. The stem is marked with closely spaced pyramidal leaf cushions measuring up to more than 1.5 inches long and arranged in a high spiral. The small ligule pit scar is located on the median line of the upper keel above the leaf scar which is convex on the upper side and V-shaped below. The vascular bundle scar tends to be somewhat concave with elliptically shaped parichnos scars on either side of the vascular bundle scar. The

elongate aerating tissue scars are below the parichnos scars on the lower keel. Transverse wrinkles are present on the median line of the lower keel. The leaves are known to be more than 30 inches long. They are entire, elongate-linear in shape, sessile, and show evidence of two rows of stomatal furrows.

With the description of this species, two species of the genus *Lepidodendron* are now known to have possessed leaves more than 30 inches in length, thus indicating a relationship in this respect with *Sigillaria*. Accurate identification of the detached leaves of *Sigillaria,* classified under the form genus *Sigillariophyllum,* and *Lepidodendron,* classified under the form genus *Lepidophyllum,* is made less promising with the description of this long-leaved species. The development of the long foliar organs in both *Lepidodendron* and *Sigillaria* represents the maximum development of the microphyllous condition in plants.

VITA

Robert Max Kosanke was born in Park Ridge, Illinois, on September 4, 1917. He received his elementary and high school education in the public schools of Park Ridge, graduating from Maine Township High School in 1936. He then entered Coe College and received the degree of Bachelor of Arts in geology in June, 1940. He entered the graduate school of the University of Cincinnati and received the degree of Master of Arts in botany in June, 1942. He continued to pursue graduate study at the University of Cincinnati until January, 1943, when he became Research Assistant in the Coal Division of the Illinois State Geological Survey. He continued his graduate studies at the University of Illinois during 1944 and 1945 and resumed them in 1949. He became a Geologist in the Coal Division of the Illinois State Geological Survey in 1950. He is a member of the Botanical Society of America, Torrey Botanical Club, American Association for the Advancement of Science, Geological Society of America, Paleontological Society, Illinois Mining Institute, Illinois Academy of Science, Iowa Academy of Science, and the honorary societies of Sigma Xi, and Sigma Gamma Epsilon. He is the author of "Characteristic plant microfossils of the Pittsburgh and Pomeroy coals of Ohio," "Staining plant remains in calcareous coal balls," "Plant microfossils in correlation of coal beds," "Pennsylvanian spores of Illinois and their use in correlation," "A type of boghead coal from Illinois," and co-author with L. R. Wilson of "The microfossils in the Pre-Kansan peat deposit near Belle Plaine, Iowa," and "Seven new species of unassigned plant microfossils from the Des Moines Series of Iowa."